

## Dual Pumping and Tandem Pumping

Dual Pumping and Tandem Pumping are two different water supply procedures used for two different purposes. The terms are commonly misused in the fire service. Even amongst various authors of published articles some will misuse the terms. Dual pumping is two Engines using the same hydrant to take advantage of available water left in the hydrant after the 1<sup>st</sup> Engine is flowing its capacity or desired flow. Tandem Pumping is a two Engine relay used to overcome friction loss in elevation.

### Dual Pumping

**Purpose:** To establish a procedure using two Engines to maximize available water left in a high flow hydrant after the 1<sup>st</sup> Engine is flowing its capacity or desired flow.

**Background:** This procedure may prove to be a poor tactic in areas with multiple hydrants in close proximity to each other. The reason being is that in most full assignments where 1<sup>st</sup> units due in the front and rear layout or have their own water supply from a hydrant. If the 1<sup>st</sup> units have their own water supply on the hydrant the 2<sup>nd</sup> units arriving, on that side of the building, should prepare to establish water supply to a secondary hydrant incase the 1<sup>st</sup> hydrant on that side of the building fails.

There are a few places Engines could use this procedure. For instance, if there is a fire in an area where there are few hydrants or the secondary hydrants are too far apart for water supply Engines to use in a practical manner. This procedure may be advantageous in situations where Engines would have to lay across railroad tracks or divided highways to gain access to secondary hydrants. In this case Two Engines would share one hydrant if the flow in the hydrant was available.

The one thing for pump operators to understand is how to estimate remaining water left in a hydrant. Once the 1<sup>st</sup> Engine has flown its rated capacity or desired flow they must be able to determine how much more water is available in the hydrant.

#### Estimating Hydrant Capacity Formula

##### Static - Residual

Static

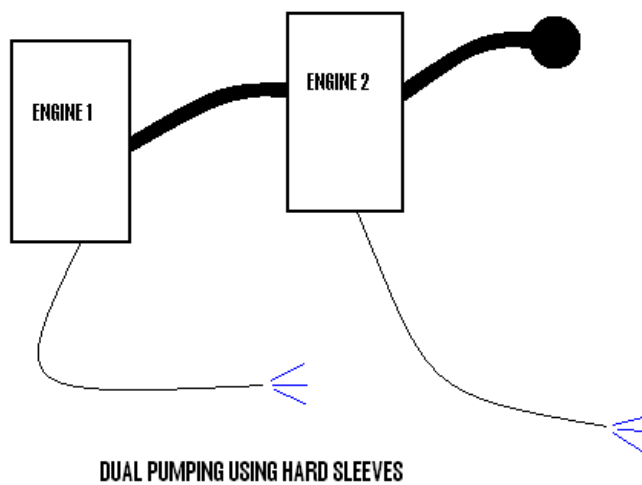
10% used  $\frac{1}{3}$  used 2x water available

25% used  $\frac{1}{2}$  used 1x water available

**Procedures:** There are several procedures to accomplish dual pumping. With a variety of manufacturers of pumps and Engine companies, procedures may vary depending on the configuration of the pump and the appliances that Engine has available to them.

Procedure #1 for Engines without Gated Main Intake Valves

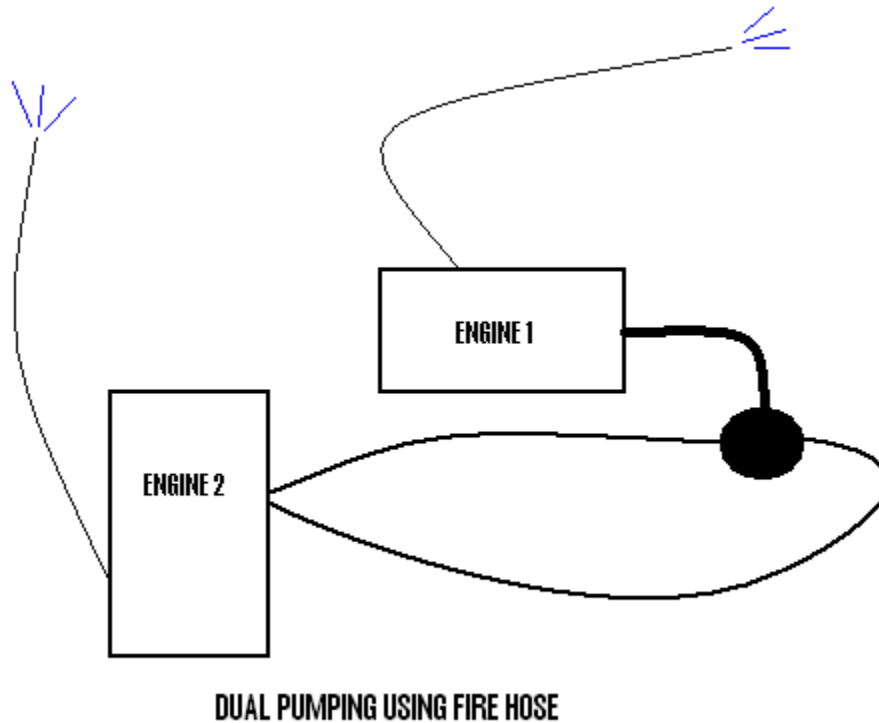
1. Engine 1 established own water supply from hydrant via soft/hard sleeve.
2. Engine 1 places transfer valve in “Volume” position.
3. Engine 1 flows rated capacity or desired flow.
4. Engine 1 estimates remaining water left in hydrant, if more available 2<sup>nd</sup> Engine will prepare to be supplied from the same hydrant.
5. Engine 1 closes hydrant until their intake pressure is at or near 0 psi (less than < 5psi).
6. Both Engines remove main intake blind caps quickly and connect hard sleeves to both main intakes using appropriate adaptors. If intake becomes below 0 psi, the steamer cap may be hard to get off due to negative pressure. Once the cap is removed it would suck in air affecting hose streams. Keep intake pressure above 0 psi. When cap is removed some water will come out the intake. Intake gauges are not a perfect indicator of residual pressure after the hydrant is gated back.
7. Engine 2 places transfer valve in “Volume” position.
8. Engine 1 opens hydrant completely and the 2<sup>nd</sup> Engine will receive the remaining water left in the hydrant or desired flow.



## **Procedures: (continued)**

### Procedure # 2 for Engines without Hard Sleeves or not rated for positive pressures

1. Engine 1 established own water supply from hydrant via soft sleeve and place hydrant gate valves on the two 2 ½" outlets on the hydrant.
2. Engine 1 flows rated capacity or desired flow.
3. Engine 1 estimates remaining water left in hydrant, if more available 2<sup>nd</sup> Engine will prepare to be supplied from the same hydrant.
4. Engine 2 will connect two supply lines, any size threaded or stortz, to the hydrant and the other end of the hoses to their intakes. Open hydrant gate valves and intake valves and receive water.
5. Engine 2 will flow remaining water left in the hydrant or the required flow.



## **Procedures: (continued)**

### Procedure # 3 for Engines with Gated Main Intake Valves

1. Engine 1 established own water supply from hydrant via soft/hard sleeve.
2. Engine 1 flows rated capacity or desired flow.
3. Engine 1 estimates remaining water left in hydrant, if more available 2<sup>nd</sup> Engine will prepare to be supplied from the same hydrant.
4. Engine 2 places transfer valve in “Volume” position.
5. Both Engines hook hard sleeves to the main intakes, using appropriate adaptors, and open their gated intake relief valves.
6. Engine 2 will receive the remaining water left in the hydrant and flow the required flow.

### **Key Operational Considerations:**

- Dual pumping may be used in area with few hydrants or where hydrants are too far apart for practical use.
- Dual pumping may be used in areas where it would require Engines using secondary hydrants to cross rail road tracks or divided highways.
- Some hard sleeves are not rated for positive pressures.
- Ensure you have proper adapters if using hard sleeves; such as, 6” double females etc...
- Some Keystone valves on intakes will restrict flow.
- It may prove better to use two hard sleeves instead of one. This will give more flexibility to how you position your apparatus.

## **Tandem Pumping**

**Purpose:** To establish a procedure to supply water in a short two Engine Relay to overcome friction loss in elevation.

**Tactical Objective:** To provide a procedure to supply water to a standpipe system in upper floors in high rise buildings, when the fire pump is out of service, using a two Engine Relay to overcome friction losses in elevation.

**Background:** Standpipe systems require 500gpm at 150psi to the connection and 5psi to each floor above the ground level. Pressures required on upper floors may require pressure too high for one Engine company to provide the required flow (GPM) even if they could achieve the pressures. The use of two Engines will be utilized so that the 2<sup>nd</sup> Engine will take advantage of incoming pressures from the 1<sup>st</sup> Engine to supply the Standpipe connection. Engines may be required to supply a sprinkler system or combination system as well.

For instance Fire on the 40<sup>th</sup> Floor of high rise building with fire pump out of service:

40 floors x 5psi per floor = 200psi in elevation

Standpipe connections require 150psi to the connections at 500gpm

200psi (elevation)

$$\begin{array}{r} + \text{ 150psi (to connection) } \\ = 350\text{psi} \end{array}$$

*Centrifugal pumps are rated as follows:*

*150psi = 100% capacity of pump*

*200psi = 70% capacity of pump*

*250psi = 50% capacity of pump*

*350psi = ? considerably less*

Now let us say we have 50psi intake from a hydrant to Engine 1. Engine 1 supplies 150psi at 500gpm minimum + 50psi from hydrant for a total of 200psi to Engine 2. The net pump pressure is still only 150psi.

Engine 2 has 200psi to their intake and pumps the connection at 350psi. Engine 2's Net Pump Pressure is still only 150psi and they could supply their rated capacity at 150psi.

$$\begin{array}{r} 350\text{psi (discharge pressure)} \\ - \text{ 200psi (intake pressure from Engine 1) } \\ = 150\text{psi (Engine 2's Net Pump Pressure)} \end{array}$$

## **Background (continued)**

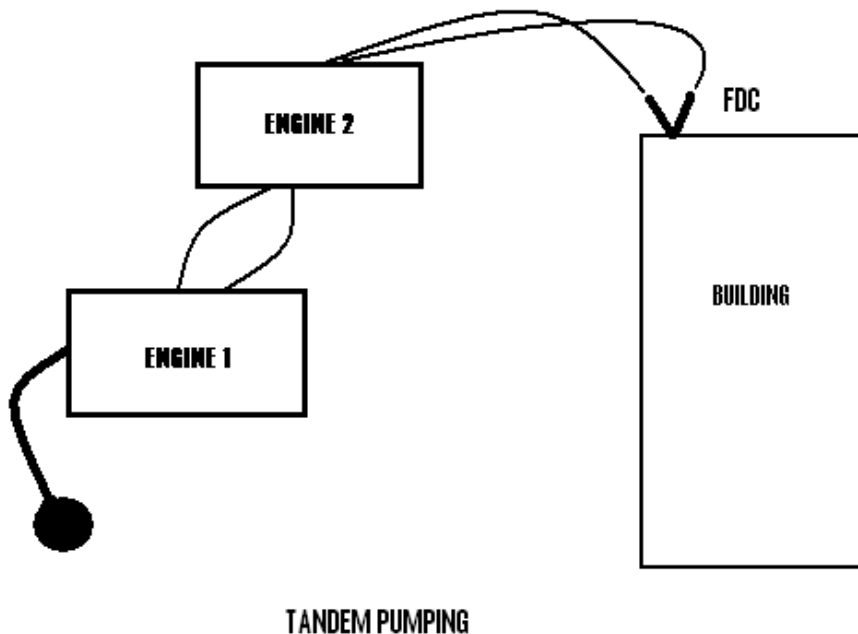
Pump operators must understand what Net Pump Pressure is and how centrifugal pumps take advantage of incoming pressure.

NFPA 20, The Standard for the Installation of Centrifugal Fire Pumps, does not allow fire department connections (FDC) to be on the intake side of the building's fire pump. Most buildings are supplied through the discharge side of the building's fire pump. The reason is that if Engines supply water through the intake side of the building's centrifugal fire pump, the pumps intake relief valve will open and dump the excessive pressure of water above 125psi, typically. In this instance the fire department can not control the pressures in the standpipe system in the building. There are a few buildings constructed with FDC supplying the system to the intake side of the building's fire pump. Consider pumping into the 1<sup>st</sup> floor globe valve to bypass the building's fire pump. Know your buildings for tandem pumping.

### **Procedure:**

1. Engine 1 establishes water supply to a hydrant via soft sleeve.
2. Engine 1 places transfer valve in "Volume" position.
3. Engine 2 parks close to, less than <100 feet, from Engine 1.
4. Engine 2 places transfer valve in "Pressure" position.
5. Engine 2 blind caps intake relief valve, most are set at 150psi. Some Engines have adjustable intake relief valves. Adjusting this would be safer than blind capping the intake valve.
6. Engine 2 closes auxiliary coolers, circulating lines, tank fill lines, tank-to-pump valves, and discharge relief valves so that high pressures do not cause damage.
7. Engine 1 supplies required flow and pressure to Engine 2 through treaded coupling type supply lines.
8. Engine 2 takes advantage of the intake pressure from Engine 1 and supplies required flow and pressure to the fire department connection utilizing discharges on the opposite side of the pump operator's panel while opening valves slowly.

**Procedure: (continued)**



**Key Operational Considerations:**

- With high pressures, hoses and fire department connections must be tested prior to use.
- Most fire hose we use on our apparatus is tested two ways, Acceptance tests and Service tests. Service tests are done typically at 300psi which means we can only flow at 250psi.
- There is hose made for use with high pressures. NYC and LA fire Departments use hose with acceptance tests at 2000psi. Some departments that use hose for high pressures use extruded aluminum couplings and not pyrolite couplings because they are stronger.
- Hose lines at pump panels must be tied off near couplings like in hose testing. Keep people clear of hose and connection. Discharges opposite the pump operator's panel should be used to supply the standpipe connections so the pump operator does not get hit by any burst hose line or coupling. Pressures are at the highest here in this short relay.
- Do not use LDH. Most LDH is not rated for high pressures and the couplings may not hold up. Use threaded couplings only.
- Shut down at water supply first to prevent water hammer.

**Key Operational Considerations: (continued)**

- There are Engines manufactured with 3 stage pumps that are used to supply connection in high rises. Most are limited to one discharge and limited in the amount of flow.
- Close auxiliary coolers, circulating lines, tank fill lines, tank-to-pump valves, and discharge relief valves so that high pressures do not cause damage.
- Consider marking hose at couplings with a magic marker that is used to supply standpipe FDC. Check after tandem pumping to see if it moves more than  $\frac{1}{8}$  inch after high pressures have been flowing through it. If so remove from service.
- FYI - One of Montgomery County's tallest buildings is Washingtonian Towers, 26 stories.